Small Wireless Facilities

Meeting the Needs of Customers Today and Preparing for the Future

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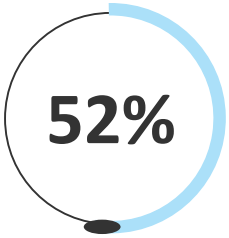
Why are we expanding the wireless network?

More people than ever before rely on wireless connections to manage their lives and businesses.

Verizon is expanding its wireless network to meet the growing demands and of today and tomorrow.

Data consumed by the average North American smartphone user per month:

2016 = 5 GB
2017 = 7 GB
2023 est. 48 GB



About 52% percent of American households are wireless-only.[2]

In North America, the average household has 13 connected devices with smartphones outnumbering tablets 6 to 1.[3]

1. Cisco VNI Mobile Forecast Highlights, 2016 – 2021, February 2017
2. CDCs 2016 Wireless Substitution: Early Release of Estimates From the National Health Interview Survey, January - June
3. IHS Markit Connected Device Market Monitor: Q1 2016 , June 7, 2016

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A wireless network is like a highway system

We need to add capacity to the existing wireless network infrastructure to stay ahead of ever increasing traffic demands.

More wireless traffic needs more wireless facilities just like more vehicle traffic needs more lanes.

- Many wireless users share each cell site and congestion may result when too many try to use it at the same time.
- Wireless coverage may already exist in an area, but with data usage growth increasing exponentially each year, more capacity is needed.
- To meet capacity demands, we need to add more wireless antennas closer to users and closer to other cell sites to provide the reliable service customers have come to expect from Verizon.

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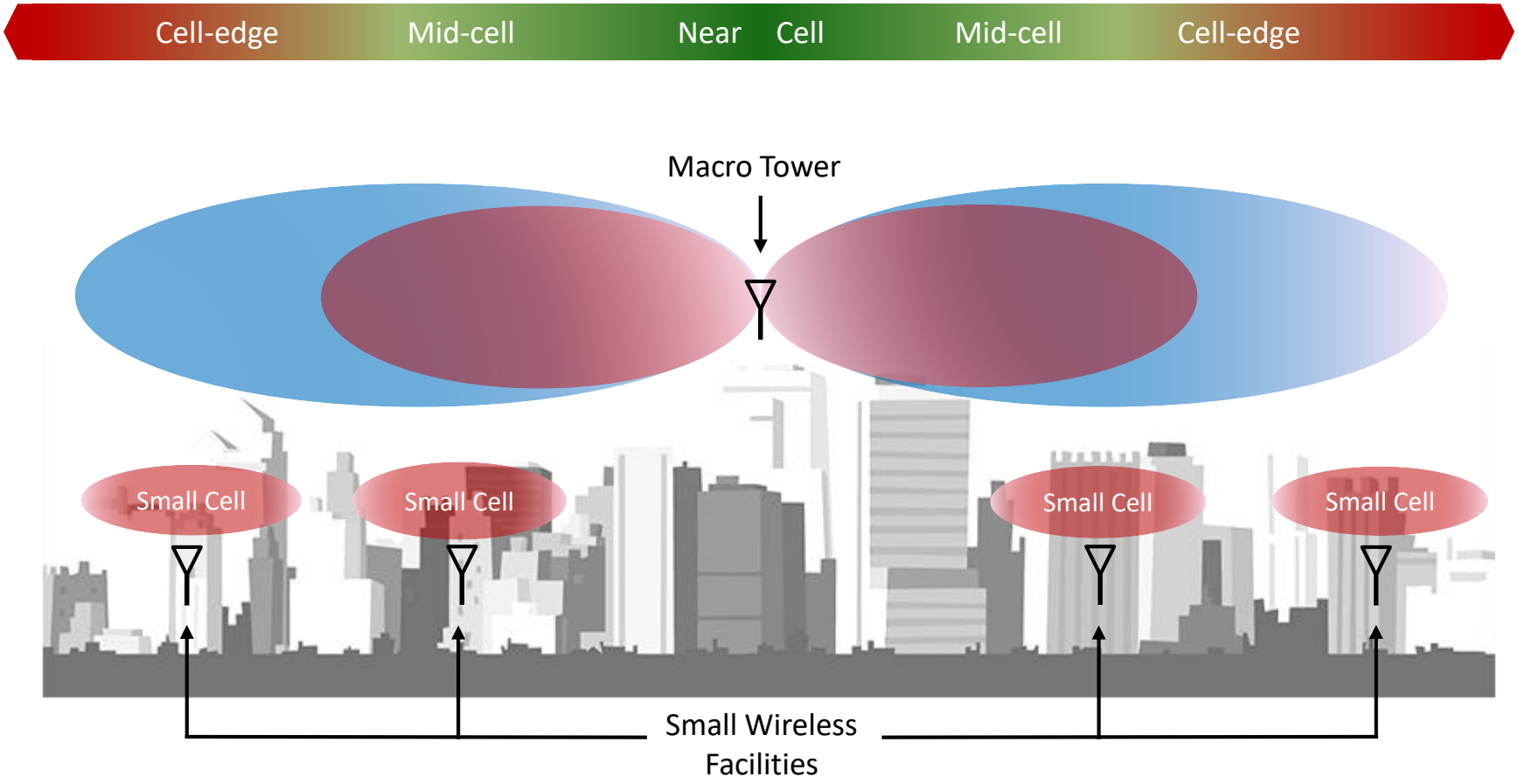
Small Cells

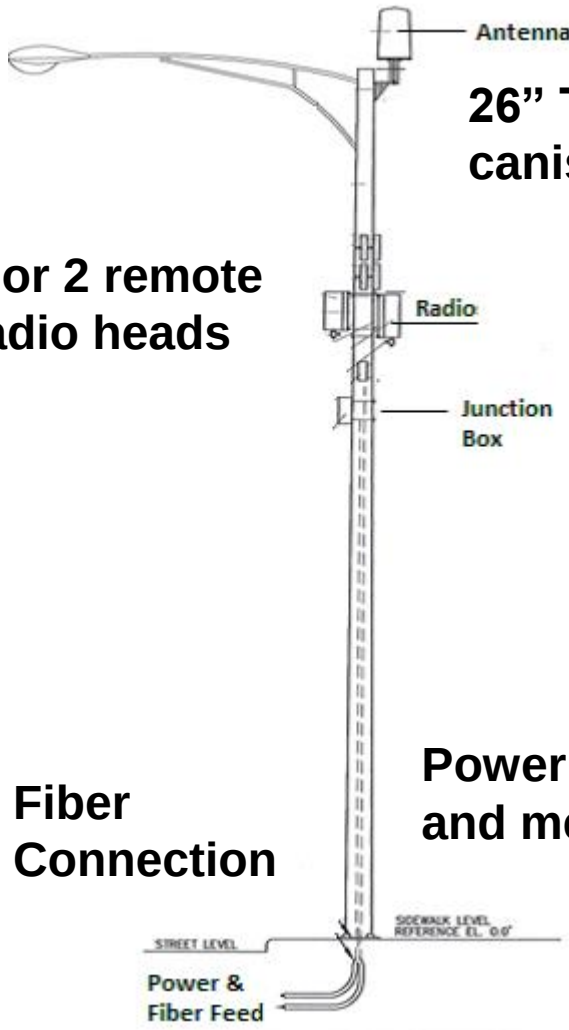
- **Small cells** are just like the name implies – short range cell sites used to complement macro cell towers in a smaller geographic area ranging from a few hundred to 1,000 feet.
- These lower power antennas enhance capacity in high traffic areas, dense urban areas, suburban neighborhoods, and more**.**
- **Small cells** use small radios, antennas and support equipment that can typically be installed atop utility poles and street lights.
- Unlike traditional cell towers, small wireless facilities are designed to blend into the existing environment as much as possible, making them less obtrusive and more aesthetically pleasing.

Macro Towers vs Small Wireless Facilities



Small Cells accelerate the benefits of 4G LTE, next generation 5G, the Internet of Things, machine-to-machine technology, and smart cities solutions for consumers and businesses.

What is a Small Cell?



26” Tall x 12” Diameter canister antenna

1 or 2 remote radio heads

Power cable and meter

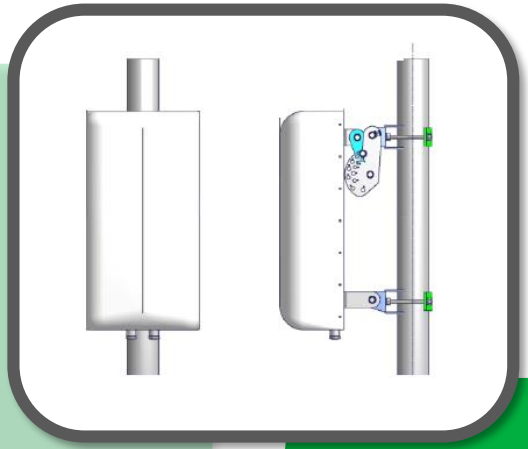
Fiber Connection

Antenna Options

Cylindrical

Height
1 to 4 ft.

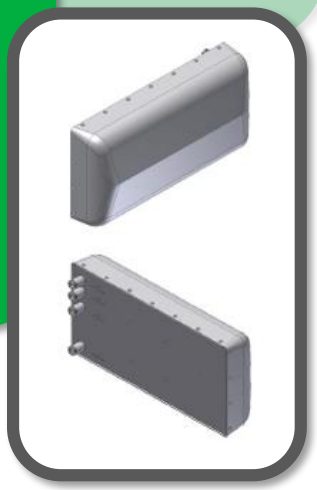
Diameter
~16 in.



Panel

Height
1 to 4 ft.

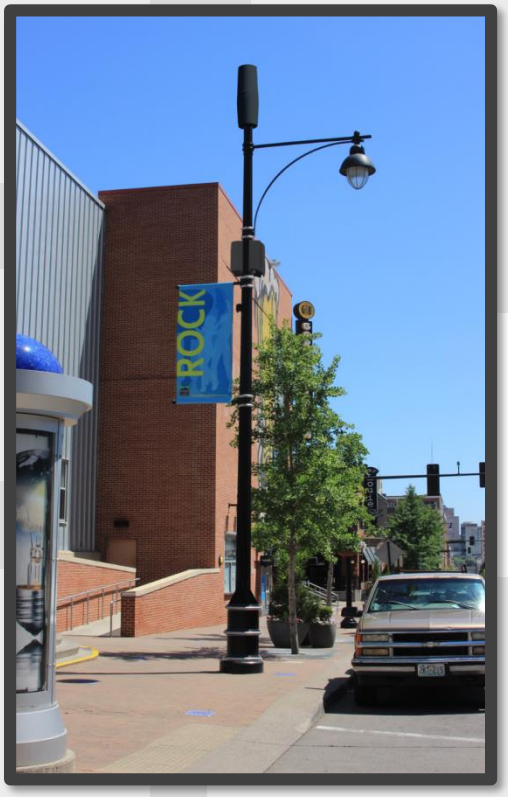
Width
1 to 3 ft.



Design Options: Street Lights

San Francisco, CA

Minneapolis, MN



Kansas City, KS

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Design Options: Utility Poles

Elsmere, DE

Bernardsville, NJ

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Small Cells will Set the Stage for 5G Technology

Fifth generation wireless technology, also known as "5G", will deliver enhanced mobile broadband capabilities that are up to 100 times faster than speeds today with immediate responsiveness.

5G will be transmitted over higher wave frequency spectrum bands.

- Higher frequency bands do not propagate well – they typically require "line-of-sight" and do not pass through obstacles.
- This will require a high level of cell densification via "small cells" in locations such as lampposts, buildings, and utility poles.

5G will:

- **Be very fast** - 3G = 384 Kbps, 4G – 100 Megs, 5G > 1 Gig. Download speeds of 30-50 times faster than 4G.
- **Connect everything**, supporting the Internet of Things. Today there are 8.4 billion connected "things" in use – up 31% from 2016. With 5G that number will increase to more than 20.4 billion by 2020.
- **Be real-time**, minimizing delays in network response and enabling entirely new services and applications. Response time on 4G is 15-60 milliseconds; will drop to 1 millisecond on 5G making lag times nearly impossible to detect.

Economic Impact from Wireless Connectivity

- The current stage of growth is propelled by **improvements in efficiency** and other rapid gains. Information that was previously difficult to acquire is now easily accessible, enabling businesses to better analyze performance and identify opportunities to improve operations. [1]

- The next stage of growth will come not just from efficiency gains, but also from **reductions in failure rates, increased productivity, and new functional capabilities.**

  - **Energy** – Smart grid adoption enabled by wireless connectivity could create 1.8 trillion in additive revenue to the US economy and save consumers hundreds of dollars per year.

  - **Health** – Connected devices could create $305 billion in annual health system savings from decreased costs and mortality due to chronic illness.

  - **Public Safety** – Improvements enabled by wireless connectivity have the ability to save lives – a one-minute improvement in response time translates to a reduction of 8% of mortality and to reduce crime and the cost of law enforcement.

  - **Transportation** – Self-driving cars could reduce emissions by 40-90%, travel times by nearly 40% and delays by 20%. Self-driving cars could save 21,700 lives and $447 billion per year.

1 "Wireless Connectivity Fuels Industry Growth and Innovation in Energy, Health, Public Safety, and Transportation," Deloitte, Jan. 2017.

Thank you.

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